

WHAT IS CLAIMED IS:

1. An apparatus for sensing the absolute value of the rotational position of a shaft (14) of a motor (10), comprising:

a) a first single-turn rotary encoder (30) that is arranged at one end (20) of the shaft (14) and is configured to sense the shaft's rotational position within a single revolution; and

b) a multi-turn rotary encoder unit for sensing the number of revolutions of that shaft (14), said multi-turn rotary encoder unit comprising:

i) a reduction gear linkage (18), drivable by the shaft (14), and having an output element (38; 71);

ii) a rotary element (42; 94), connected to said output element (38; 71), that is located beyond said one end of the shaft (14) but along a common axis (24) therewith; and

iii) a second single-turn rotary encoder (48; 48') which is configured to sense the rotational position of the rotary element (42; 94) within a single revolution;

said reduction gear linkage (18) being arranged annularly about a portion of the shaft (14); and said output element (38; 71) of said reduction gear linkage (18) being connected to said rotary element (42; 94) around the first single-turn rotary encoder (30) via a connecting member (40).

2. The apparatus according to claim 1,  
wherein driving motion applied by the shaft (14) to the reduction gear linkage (18) translates into a motion coaxial with motion of the shaft.

3. The apparatus according to claim 2,  
wherein the connecting member comprises an essentially U-shaped yoke (40).

4. The apparatus according to claim 1,  
wherein the first single-turn rotary encoder (30) comprises a first sensor (26) and a permanent magnet (22) coaxing therewith, said magnet being arranged on an end face of the shaft (14).

5. The apparatus according to claim 4,  
wherein the first sensor comprises a giant magneto-resistive (GMR) sensor (26).

6. The apparatus according to claim 3,  
wherein the second single-turn rotary encoder (48) comprises a second sensor (46) and a permanent magnet (44) coaxing therewith, the magnet being arranged on the rotary element (42).

7. The apparatus according to claim 6,  
wherein the second sensor comprises a giant magneto-resistive (GMR) sensor (26).

8. The apparatus according to claim 4,  
wherein a magnetic shield (96; 106) is provided between the first (30) rotary encoder and second rotary encoder (48), in order to at least partially magnetically uncouple those rotary encoders from one another.

9. The apparatus according to claim 8,  
wherein the magnetic shield (96; 106) is arranged adjacent the rotary element (42; 94).

10. The apparatus according to claim 1,  
wherein the first (30) and the second single-turn rotary encoder (48) are arranged adjacent a shaft end (16; 20) of the motor shaft (14) opposite to an input drive end of that shaft (14).

11. The apparatus according to claim 4,  
wherein the sensors (26, 46') of the first (30) and the second single-turn rotary encoder (48') are arranged on a common sensor carrier (106).

12. The apparatus according to claim 11,  
wherein the common sensor carrier (106) is formed, at least locally, from  
a magnetically shielding material, in order to magnetically uncouple the  
sensors (26, 46') of the two rotary encoders (30, 48') from one another.

13. The apparatus according to claim 1,  
further comprising an evaluation unit (34) which receives the output  
signals of the two rotary encoders (30, 48; 48') and generates a common output  
signal (35).